What is claimed is:

1. A method for controlling the diameter of carbon nanotubes grown by chemical vapor deposition (CVD) or by plasma enhanced chemical vapor deposition(PECVD) in the range of about 0.2 to about100 nanometers comprising:

introducing a catalyst substrate into a CVD OR PECVD growth reactor;

increasing the reactor chamber temperature to a desired growth temperature;

flowing reactive gases including a carbon containing precursor; and

controlling the residence time of the carbon containing precursor in the reactor to control the diameter of the carbon nanotubes.

2. The method of claim 1 wherein the residence time of the carbon containing precursor in the reactor is controlled by establishing a controlled pressure in the reaction chamber and adjusting the gas flow rate of the carbon precursor.

3. The method of claim 1 wherein the residence time of the carbon containing precursor in the reactor is controlled by establishing controlled gas flow rates into the reactor and adjusting the pressure in the reactor.

4. The method of claim 1 wherein the residence time of the carbon containing precursor in the reactor is controlled by adjusting the gas flow rate and the growth pressure of the reactor.

5. The method according to any one of Claims 1, 2, 3 or 4 wherein the growth temperature is about 400 to about 1200°C.

6. The method according to any one of Claims 1, 2, 3 or 4 wherein the catalyst contains transition metal particles.

7. The method according to Claim 6 wherein the catalyst comprises at least one member selected from the group consisting of Fe, Mo, Co, Ni, Ti, Cr, Ru, Mn, Re, Rh, Pd, V or alloys thereof.

8. The method according to any one of Claims 1, 2, 3 and 4 wherein the catalyst particles have a size about 0.2 nanometers to about 100 nanometers.

9. The method according to any one of Claims 1, 2, 3 and 4 wherein the carbon containing precursor comprises at least one member selected from the group consisting of aliphatic hydrocarbons, aromatic hydrocarbons, carbonyls, halogenated hydrocarbons, silyated hydrocarbons, alcohols, ethers, aldehydes, ketones, acids, phenols, esters, amines, alkylnitrile, thioethers, cyanates, nitroalkyl, alkylnitrate, and mixtures thereof.

10. The method according to any one of Claims 1, 2, 3 or 4 wherein the carbon containing precursor comprises at least one member selected from the group consisting of methane, ethane, propane, butane, ethylene, acetylene, carbon monoxide and benzene.

11. The method according to any one of Claims 1, 2, 3 or 4 which comprises employing a carrier gas along with the carbon precursor.

12. The method of claim 11 wherein the carrier gas comprises at least one member selected from the group consisting of argon, nitrogen, helium, hydrogen and ammonia.

13. The method according to any one of Claims 1, 2, 3 or 4 wherein the flow rate or pressure or both is adjusted such that the residence time in the reactor can be varied from about 1 minute to about 20 minutes, to tune the CNT diameter.

14. The method according to any one of a Claims 1, 2, 3 or 4 wherein the flow rate or pressure or both is adjusted so that the residence time can be varied between about 1.2 minutes to about 10 minutes to tune the CNT diameter.

15. The method according to any one of claims 1, 2, 3 or 4 wherein the diameter of the carbon nanotubes is smaller than the particle size of the catalyst.

16. A carbon nanotube or array of carbon nanotubes obtained by the process according to any one of claims 1, 2, 3 or 4.

17. A structure comprising a single CNT or an array of CNTs has lithographically defined origins formed by the process of: depositing a thin film of catalyst;

- lithographically patterning the thin film of catalyst;
- removing unwanted catalyst defined by the lithographic pattern;

growing nanotube with a well controlled diameter ranging from about 0.2 nanometers to about 100 nanometers by controlling the residence time of gases in the reactor used for the growing of the nanotube.

18. The structure of claim 17 wherein the catalyst comprises at least one member selected from the group consisting of Fe, Mo, Co, Ni, Ti, Cr, Ru, W, Mn, Re, Rh, Pd, V or alloys thereof.

19. An FET comprising source and drain regions and a channel located between the source and drain regions obtained by a process comprising:

depositing a thin film of catalyst;

lithographically patterning the thin film of catalyst to provide catalyst only in the source or drain region or both;

removing unwanted catalyst from the channel region defined by the lithographic pattern;

growing nanotube with a well controlled diameter ranging from about 0.2 nanometers to about 100 nanometers by controlling the residence time of gases in the reactor used for the growing of the nanotube and wherein the channel region extends from the source region to the drain region.

20. An integrated circuit containing one or more FETs of claim 19.